First International Workshop on Potentially Hazardous Asteroids Characterization, Atmospheric Entry and Risk Assessment

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Outline for 2015 ISU SSP Planetary Defense Team Project

Madhu Thangavelu[(1)], J.D.Burke[(2)], and John Connolly[(3)]

Planetary Defense Team Project Chair, ISU SSP @ Ohio University, Athens, Ohio, Conductor, ASTE527 Graduate Space Concepts Studio,
Dept. of Astronautical Engineering, USC Viterbi School of Engineering, University of Southern California, Los Angeles, CA,90089-1191, USA, mthangav@usc.edu
ISU Faculty Planetary Defense Team Project Adviser, ISU SSP @ Ohio University, The Planetary Society, Pasadena, CA, jdburke@caltech.edu
ISU Faculty, Director ISU SSP @ Ohio University, NASA Johnson Space Center, Texas, USA johnconnolly@isunet.edu

ABSTRACT

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Introduction

Defending our home planet against hazardous asteroids and comets is a very high priority issue because a high energy impact by larger objects has the potential to literally wipe out large population centers, decimate flora and fauna, upset our fragile climate and cause incalculable damage to critical physical infrastructure. Such an event will be extremely difficult if not impossible to recover from. So it is imperative that we prepare to defend our home planet, especially since new technologies allow us to do so. Space systems and allied technologies must play a key role in planetary defense. However the advanced systems and technologies to be employed will also require unprecedented cooperation and coordination among nations that can only be achieved using state of the art information and communication networks that are maturing right now. Appropriately, NASA, the Russian Space Agency and ESA have all begun asteroid mitigation projects looking at all aspects of planetary defense. It is vital that plans to thwart or ameliorate the effects of such a cataclysmic event, should it occur, be widely disseminated to the global community, so humanity can better prepare to recover from a range of effects following such an event. Global involvement and innovative and agile organizations, creative structures in policy making and governance are a prerequisite for agile action that is necessary for effective response.

Background

Asteroid and cometary impacts on planetary bodies are a natural, ongoing residual process that remind us of solar system genesis and evolution. Though these events occur in a random manner over geologic time, periodic species extinction events on Earth have been attributed to some cataclysmic asteroid impacts. Recent observations show that such impacts happen more frequently than previously estimated in the literature. Today, however, systems are maturing that are capable enough to thwart potentially hazardous objects (PHOs) from impacting the Earth. Space technologies that can be used for planetary defense are fast approaching maturity. A range of advanced engineering systems including those required for surveillance, detection, tracking and interception as well as a host of systems for diffusing the threat including techniques for ablation, deflection and threat neutralization are available today. Established spacefaring countries are currently working on plans to engage the world community of nations in dealing with this threat that has already caused recent havoc in the city of Chelyabinsk in Russia.

Objective

Most planetary defense strategies in the literature look at long term options to mitigate the asteroid impact threat. What if the threat appears with short term notice, requiring agile response? This TP will look at all the advanced technologies associated with Planetary Defense, especially the current and projected capabilities of core space technologies and allied systems that are needed to develop a range of strategies, concepts, options and protocols based on current developments and near term projections as well as organizations around the world to shape the global policy and explore alternatives to neutralize a rogue asteroid threat in the near term. e.g., a bolide on a Earth impact terminal approach trajectory with a maximum warning time of one or two years.

Tasks to be accomplished

1) Review and document current literature and plans(including past ISU reports) as well as the state of planetary defense initiatives across space agencies worldwide.
2) Situational Awareness - Explore and document new and innovative technologies that can be employed to observe, detect and neutralize threat identified and requiring response in the short term(1-2 years).
3) Document space systems and armaments that can be used for mitigating such a threat.
4) Show how advances in sensors, information technology, information networks, data processing and sharing and agile archiving and retrieval will allow rapid evaluation of threat and response options.
5) Create a set of credible plans to mitigate threat.
6) Visually depict a variety of threat mitigation concept architectures and their various systems and operational modes.
7) Failure Modes and Effects Analysis -Contingency plans and Fallback Options – Show failure tree. Depict a range of consequences for Earth and humanity in the event of inaction or system failure. i.e., aftermath of an impact. e.g., effects of sudden and complete loss of critical physical civil infrastructure including food and agriculture, habitats, power, ground communications and access to primary healthcare, breakdown of public health infrastructure, quick deterioration of quality of life and rapid spread of disease and secondary effects like pandemics.
8) Show other applications and uses for this planetary defense architecture, once such a global infrastructure is built and commissioned.
8) Depict alternative critical paths and timeline (stages) for recovery after impact
9) Show how planetary defense can be a vital tool not only to protect Earth but also to engage the nations of the world, both spacefaring and those aspiring, to be part of a vital and peaceful global effort.
10) Present plans for implementing a system(s) to engage global community in education and outreach. Show how NGOs, small business and commerce would contribute to this endeavor.
11) Produce an illustrated report that details all the creative activity.
12) Present and publish proceedings at relevant conferences

Conclusion

Since asteroid or comet impact poses a global threat, like climate change, Planetary Defense aspires to all humanity. Technologies are maturing that can be commissioned to mitigate this threat. It is imperative that we find ways to integrate all peoples and nation states in this global endeavor. ISU is an ideal platform to promote a range of issues, both technology and

currently joining forces to examine the problem. The United Nations Office of Outer Space Affairs(UN OOSA) has convened several meetings in the past few years to understand the nature of this threat and coordinate response alternatives on a global scale. The broad scope of this TP offers a major exposure to all the disciplines. It is important to act on it in a timely manner so ISU might be an active partner to lead the charge in this global endeavor.

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